THE UNIVERSITY OF WASHINGTON

Arboretum *bulletin*

WINTER 1967

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THE UNIVERSITY OF WASHINGTON

Arboretum bulletin

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COVER PHOTO:

Chamaecyparis Lawsoniana

PHOTO BY: DON NORMARK

Arboretum Report

Brian O. Mulligan

Maintenance and Improvements

More important work performed during this year included rebuilding the fence outside the old nursery area south of the greenhouses, the cleaning of two of the three ponds, the removal of ivy on the bank behind the beehives in the nursery area and about fifty dead or dying trees, chiefly native maples, throughout the Arboretum. The roof of the Look-out above Azalea Way was recovered with new shingles; three of the cable gates to the service roads were moved nearer to Arboretum Drive; two tons of ground limestone were applied on the grass areas and a ton of cottonseed meal to the hollies, camellias, and many of the rhododendrons. The road leading to the Look-out along the south side of Rhododrendron Glen was reconstructed and resurfaced and much other necessary work done on the service roads, parking lots, and drain and water systems. In addition, certain groups of plants, including pines, cherries, and hollies, were sprayed to control various pests, Casoron was applied to control horsetail, and other materials used for weeds in the nursery. 140 metal hoops were placed along the path edges in the Japanese garden.

The large collection of Asiatic quinces was pruned, as well as the roses on the Broadmoor fence and young trees along the Boulevard and elsewhere.

New Plantings

729 plants were set out during this period. Few large group plantings were made, except for the addition of 19 hollies to the collection, but many smaller groups or single specimens. Included were 48 heathers of five kinds on the bank north of the rock garden, a group of *Vaccinium* and other ericaceous plants near the Winter Garden (29 in all), and additions to the maples, mountain ashes, true firs *(Abies)*, pines, birches, red oaks, hydrangeas, camellias and a small collection of dwarf Japanese evergreen azaleas. Planting began mid-October 1966 and continued until early May.

Space has been allocated in the nursery to accommodate seedling hybrid *Populus* plants, raised by Dr. R. F. Stettler of the College of Forest Resources.

Acquisitions

(a) Plants and seeds

A very wide variety of plants has been received during the year, from many sources; the following are some of the most important:

A notable collection of 79 kinds of Japanese maples, from Mr. Rod Searles, Indianapolis, Ind. Various young trees or shrubs, from the U. S. Department of Agriculture, Glenn Dale, Md., (27 kinds); the U. S. National Arboretum, Washington, D.C., (15 kinds); the Strybing Arboretum, San Francisco, (16 kinds); the Briggs Nursery, Olympia, Wash., (16 kinds); Duncan and Davies Nursery, New Zealand, (10 kinds); cuttings of sixteen kinds of heathers from Mr. H. W. Copeland, Falmouth, Mass.; fourteen kinds of daffodils, totalling 3,623 bulbs, from the Brown Bulb Co., Seattle; nine of lillies from the Oregon Bulb Farms, Gresham, Ore. totalling 1,335 bulbs.

Of seeds we received 447 packets from 100 sources, most of them overseas; fifty arboreta or botanical gardens were included in the donors. From the Director's early fall tour of important gardens in northern Europe fifty three collections were obtained, while Mr. Witt brought back seeds of twenty species of woody plants from California in September. Seeds of oaks from Mexico, alders from Japan, and rhododendrons from New Guinea have also been received.

(b) Books

Seventy titles have been added to the library, by purchase, gift, or from publishers for review purposes.

Some notable items are: *Wild Flowers of the United States,* Vol. 1, Pts. 1 & 2, (McGraw-Hill, New York, 1966) a gift from the Isaacson Corporation; *Les Chenes de l'Europe et de l'Orient,* by T. Kotschy (Vienna, 1862); *Salictum Woburnense,* A Catalogue of Willows, (London, 1829). (These two were purchased with funds from the Arboretum Foundation). *Figures of the Most Beautiful, Useful and Uncommon Plants* by P. Miller, 2 vols., (London, 1760) was donated by the Bloedel Foundation. The Arboretum Foundation presented ten bound volumes of the *Arboretum Bulletin* 1955-1964 inclusive.

Gifts

This year was notable for a great increase in the number and size of cash donations. In December and January the Arboretum Foundation gave $12,550 and the Unit Council of the Foundation $2,926. In March the Unit Council gave an additional $2,580. All of these sums were allocated to specific uses, including additional labor ($4,800), a training program for Japanese gardeners ($4,000), construction of an arbor in the Japanese garden ($2,750), publication of a catalogue ($4,000), purchase of books, etc.

Many donations have also been received from Arboretum Units and garden clubs; a few from private individuals, corporations and foundations. The Isaacson Corporation gave $2,000 for maintenance which paid for repairs to the Look-out as well as other work.

Public Services and Educational Activities

During this year twenty guided tours of the Arboretum were conducted, thirty five talks or lectures given, usually illustrated with Kodachrome slides, and seven demonstrations, principally on pruning trees and shrubs. The nurseryman has conducted a propagation class for professional gardeners from January through July, 1967, for which thirteen persons registered. The Arboretum Foundation organized a series of classes in the Arboretum on such subjects as propagation, botany, and landscape architecture, between September and July, 1967. Mr. Witt is experimenting with short educational color films, each 50 feet long, made on a Bauer C-2 Super 8 camera presented to us by Arboretum Unit No. 25.

233 new Kodachrome slides were added to the collection, now totalling about 3,300. There is an increasing demand for the use of these by garden clubs and Arboretum Units.

Live plant material has been supplied to the Pacific Science Center on a continuing basis for their Plant Science Exhibit.

Seeds and Plants Distributed

Approximately fifty consignments of plants were sent to other institutions and correspondents, of which ten went overseas. chiefly to Europe. We also supplied young plants of five different species to the Washington State Highway Department in April for trial purposes along highways; four were evergreen ground covers.

Arrangements were made with the State Department of Institutions (Dr. W. R. Conte, Director) to provide some surplus young trees to the new State school in Echo Glen, near Preston, both for ornamental and experimental purposes. 86 trees and a few shrubs of various kinds were planted during March and April and have grown well subsequently.

In the annual seed exchange with other institutions 4,370 packets were sent out this spring to 225 institutions and correspondents throughout the world. This is the second largest number sent in one year (in 1964-65, 4,821 packets distributed). The work involved was again performed for us by members of Arboretum Unit No. 25. Of the 281 items on our list 20% had been collected in the wild state.

Staff and Activities

With the additional funds available two more men were hired, one in April, one in May; a third half time in June.

The Director acted as leader of a group tour of famous gardens of Europe, sponsored by the People to People organization, from September 17-October 15, followed by an additional two weeks in southern England to visit other gardens and obtain plant material and seeds.

In January Mr. Mulligan and Mr. Witt attended a meeting of the Oregon State Nurserymen's Association in Eugene, at which the former read a paper and showed slides of new or unusual plants in the Arboretum. Mr. Witt went to San Diego in the first week of May for the annual meeting of the Western Chapter, International Shade Tree Conference, and as chairman of the committee concerned, reported on the current status of arboreta in the western region.

On May 5 Mr. Mulligan left to attend an International Symposium on the Biology of Woody Plants, held at Nitra, Czechoslovakia, May 10-17, at which he read a paper on this Arboretum and showed slides. Following this he spent a week in Poland, four days in Budapest and four in Zagreb, northern Jugoslavia, visiting important arboreta and botanical gardens, before joining other members of the International Dendrology Society in Dubrovnik, Jugoslavia, for a ten days tour by bus, to see the native forests and flora in that region. He returned via London, England, June 19. This tour proved most valuable for making new contacts in central and southeastern Europe.

The Director is a member of the Seattle Municipal Art Commission and of its Landscape and Architecture sub-committee.

New Committees

An event of major importance to the Arboretum during the year was the appointment by President Odegaard on February 13, 1967, of three new committees to serve Arboretum needs in different categories; they are as follows:

1. *University Committee on the Arboretum*
   Chairman, Prof. S. P. Gessel; eight other members from the University. Its duties are to review continuously plans for the development of the Arboretum, and report recommendations to Dean J. S. Bethel.
2. *Advisory Committee on Program for the University of Washington Arboretum*
   Chairman, Dean J. S. Bethel; ten other members representing the University, the city of Seattle, supporting groups and citizens. To comment on program proposals developed by the Dean of the College of Forestry, the Director of the Arboretum, and the University Committee on the Arboretum.
3. *City-University Liaison Committee*
   Chairman, Mr. E. M. Conrad; two other members from the University, three from different departments of the city government-planning, engineering and parks.

Miscellaneous

Traffic count outside offices (7/1/66–6/30/67)
155,854 vehicles; this was an increase of 5,558 vehicles over the previous year, and of 12,662 over 1964-65.

Japanese Garden Visitors
34,432; for 1965-66, 33,446; for 1964-65, 41,102

Telephone inquiries for information
2,282; in 1965-66, 2,458; in 1964-65, 2,331

Catalogue of Woody Plants
Work is continuing on this project. It is now hoped that it may be prepared for the printer by the end of this year. Funds are available for publication.

Waterfront Trail
Plans for a new Nature Trail from Foster's Island to the Museum of History and Industry have been completed and construction is anticipated in the near future. This is being financed by Federal, University and City funds, the total budget being $108,870.

Our Japanese Garden

In recent weeks and months this has been undergoing quite a transformation. Work began during August, with the construction of an arbor near the northwest corner of the garden (fig. 14); by K. Ishimitsu & Sons of Seattle, according to plans received from the office of Mr. Juki Iida, the original architect of the garden, in Tokyo, Japan.

This measures 15.5 feet square on its foundations, 8 feet from the floor to the edge of the roof. In it is a pair of benches 9 feet long set at right angles to each other and joined at the angle. The sides are open above a low screen and rail. The view from it is down the slope eastwards through the grove of Japanese cherry trees to the lake, so although it will be especially attractive in May when these are flowering, yet we can be sure that it will be used frequently at other times of the year. The cost of construction was borne by memorial funds from the Arboretum Foundation, for which we are most grateful, as this is a distinct asset to our garden.

In addition to this new construction, since the beginning of October we have had the benefit of the knowledge and skill of Mr. Yoshio Fukushima, a member of Mr. Iida's staff from Tokyo brought here for three months, again with funds from the Arboretum Foundation.

He has been busily occupied in severely pruning many of the trees and shrubs, so that one can now see through them; in building new steps up to the arbor, from sections of logs set vertically in the ground, and a flight of stone steps to the Kobe lantern on the north bank. Both of these last have also been planted, the former

(Continued on Page 97)

Below—
Looking west across bridges in Japanese Garden to new Arbor.
Fig. 14 Photo by: B. O. Mulligan

Crossing the Western Pines at Placerville, California

W. B. Critchfield and S. L. Krugman*

ABSTRACT

The results of hybridizing the western pine species by the Institute of Forest Genetics are described and discussed. It has been found that the hard (yellow) pines can generally be crossed successfully only with similar species native to the same part of the world. In contrast, the soft (white) pines of the Western Hemisphere have been crossed successfully with soft pines of the Eastern Hemisphere. The hybrids produced by the Institute have been found to have value in both the field of forestry and in improving man's environment.

In the forests of the Pacific Slope grows one of the world's great concentrations of conifers—matched in number of species only by the forests of western China. The pines in the dense forests of the Pacific Northwest are not as well represented, but their diversity in the drier forests of California is unrivalled by any stands elsewhere.

This distinction can be illustrated by the number of species of *Pinus* in the three Pacific Coast States: 4 in Washington, 8 in Oregon, and 19 or 20 in California. Central Mexico, another center of diversity in this group, exceeds California in number of species, but most of the Mexican pines (unlike those of California) belong to a few closely related species complexes. Of the 15 subgroups in this genus, 8 are represented in California compared to 5 in central Mexico.

Ever since the Institute of Forest Genetics, originally called the Eddy Tree Breeding Station, was established in 1925 at Placerville, California, most of our research has been concentrated on the pines.* Species hybridization has been an important part of this program. It has been directed toward the improvement of pines by producing superior hybrids and by transferring desirable characteristics, such as insect resistance, from one species to another. About a dozen pines are native to our operating area, and this has greatly facilitated work on species-crossing.

The two main subdivisions of this genus —the soft (or white) pines and the hard (or yellow) pines differ widely in their crossing behavior. The hard pines can generally be hybridzed only with similar species native to the same part of the world. On the other hand, among the soft pines, successful crosses between species of the Western and Eastern Hemispheres are common.

Western white pine (*P. monticola*) is a good example. This species can be crossed most readily with its very similar relative, eastern white pine (*P. strobus*), which is native to the eastern United States and Canada. But it has been crossed also with (among others) blue pine of the Himalayas (*P. griffithii*), Balkan pine (*P. peuce*), and Japanese white pine (*P. parviflora*).

Not all the white pines, however, can be crossed with each other so easily. One conspicuous exception is sugar pine (*P. lambertiana*). All our efforts to cross it with western white pine and the other North American white pines have failed. Strangely enough, we have succeeded in crossing it with two white pines native to eastern Asia—Korean pine (*P. koraiensis*) and Armand pine (*P. armandii*), the latter a very widely distributed species of China and bordering regions. Both Korean pine and Armand pine—unlike sugar pine and most

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*The Institute and its collection of pines in the Eddy Arboretum have been described by J. W. Duffield in the Winter 1949 issue of this bulletin, Vol. XII, No. 4: 17-20, 40-41. "Pines of the Eddy Arboretum."

other white pines—have wingless seeds, but otherwise they are not very similar. Our single *P. lambertiana* x *koraiensis* hybrid has not yet flowered, but one of the *P. lambertiana* x *armandii* hybrids growing at Placerville began producing cones a few years ago at the age of 12—much earlier than sugar pine ordinarily begins to flower. This tree is the first seed-producing hybrid between parents having winged and wingless seeds. Its seed wings are remarkably varied in shape; they are mostly ragged in appearance and range from rudimentary to fairly well developed (fig. 15).

One of the more interesting white pines of the West is bristlecone pine (*P. aristata*), well publicized in recent years as the oldest known living organism. In California it grows at high elevations on a few desert ranges. Its only close relative is foxtail pine (*P. balfouriana*), which grows in fairly inaccessible parts of the southern Sierra Nevada and the northern Coast Ranges of California. We have never succeeded in crossing these two pines with other species. Recent attempts to cross them with each other, though, have been highly successful; in fact, there seems to be little if any crossing barrier between the two. In this they are unique among the pines—crosses between different pine species ordinarily yield far fewer offspring than crosses between two trees of the same species.

Among the hard pines, the most important in the West are the western yellow pines. This group includes ponderosa pine (*P. ponderosa*), Jeffrey pine (*P. jeffreyi*), and many of the Mexican pines. Most of the western yellow pines that we have worked with can be crossed with each other. But none of them has been successfully crossed with the rather similar yellow pines that make up the extensive pine forests of the southeastern United States. Nor have any of the western yellow pines been crossed successfully with the numerous hard pines of Europe and Asia.

Of the many western yellow pines, we have investigated most thoroughly the crossing behavior of ponderosa pine. It is one of the most readily hybridized species in the western United States. To date we have crossed it with both of its California relatives—Jeffrey pine and Washoe pine (*P. washoensis*)—and with several species centering in Mexico—*P. montezumae, P. hartwegii, P. engelmannii, P. durangensis,* and *P. pseudostrobus.*

Jeffrey pine resembles ponderosa pine and grows with it in many areas, but it behaves quite differently from ponderosa in crosses with other species. We have succeeded in crossing it with ponderosa and several of ponderosa's close relatives, but Jeffrey pine does not cross readily with any other species. Jeffrey pine also differs from ponderosa in its ability to cross with Coulter pine, one of the big-cone pines of California. This last hybrid, Jeffrey x Coulter, has shown a high resistance to a weevil that often destroys young pine plantations in California. Because of its resistance to this

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Below—
Sugar Pine × Armand Pine—18-year-old, 40-foot hybrids of a cross between one of our most important commercial western soft pines and a soft pine from eastern Asia.

Photo: Courtesy Institute of Forest Genetics, Placerville, Calif.
Fig. 15

insect this hybrid has potential as a forest tree.

The big-cone pines—Coulter (*P. coulteri*) Digger (*P. sabiniana*), and Torrey (*P. torreyana*)—differ from other western pines in their large cones and long needles. Digger pine is one of the few pines that characteristically develops a multistemmed crown. The heavy spiny cones of Coulter pine are the most massive cones produced by any of the pines. Torrey pine's five needles per bundle make it the only hard pine in the United States with more than three needles in a bundle. It is also exceptional in its extremely restricted range: a few miles of coastal bluffs north of San Diego and one small grove on Santa Rosa Island, off the coast of southern California.

The three big-cone species have proved to be among the most difficult to cross of any of the pines. Coulter and Jeffrey pines were first crossed more than two decades ago, but for years we were unsuccessful in crossing Coulter with the other big-cone species. Only recently have we produced a single Digger x Coulter hybrid. Digger pine can also be crossed (and somewhat more easily) with Torrey pine. The hybrids, which have not yet reached cone-bearing age, are nearly indistinguishable from Digger pines of the same age. They can easily be identified as hybrids, however, by the chemical composition of their wood resin. The turpentine fraction of Digger pine's resin is mostly limonene; in Torrey pine it is nearly all heptane; and in the hybrids the proportions of these two compounds range from 1:1 to 1:2.4.

One of the most variable and wide-ranging of the western pines is *P. contorta*. Its coastal race, which extends from Alaska to California, is commonly called shore pine. Another race—generally known as lodgepole pine—grows in the upper-elevation forests of the Cascade Range and the Sierra Nevada. These two races are so different in morphology that they are sometimes considered different species. The hybrid between shore and lodgepole pines has possibilities as a Christmas tree. It combines some of the desirable features of both parents. It has shore pine's thick green foliage, persistent cones, and multinodal growth. In addition, it has the well-formed sturdy crown of mountain lodgepole pine. During the past few years we have crossed the two on a large scale. Despite the differences between them, we have found no indication of any barrier to crossing them. Shore pines cross as readily with lodgepole pines as they do with other shore pines, and this is true of lodgepole as well. The complete absence of crossing barrier has reinforced our view that these two forms should be considered races of the same species.

The first hybrid produced at the Institute of Forest Genetics was the cross between knobcone (*P. attenuata*) and Monterey (*P. radiata*) pines. It combined two of the three closed-cone pines that grow in California. Planted in 1929, these hybrids are still growing at Placerville and have now reached a height of about 80 feet. Their pollen parent, Monterey pine, is one of the most widely planted trees in the world. It plays a major role in the forest economies of New Zealand, Australia, and other countries. The other parent, knobcone pine, is of no importance as a timber tree, but it grows on a much wider range of soils and in much colder and drier climates than Monterey pine. The cross between knobcone and Monterey pines yields quantities of hybrid seed, so the production of large numbers of first-generation hybrids is biologically feasible. This hybrid is being produced and tested on a large scale in California and elsewhere, with the object of combining knobcone pine's tolerance of poor sites and cold climate with Monterey pine's desirable characteristics as a wood producer.

The third closed-cone species of California is bishop pine (*P. muricata*). This pine grows along the Pacific Coast in a string of isolated stands extending from northern California to Lower California. Within this range several well-defined geographic races have evolved. These races, unlike those of

P. contorta referred to above, are not always easy to cross, and some of them cannot be crossed at all. For example, we have been completely unable to cross a blue-foliaged race that grows along the coast of northern California with some of the green-foliaged southern races. Bishop pine is highly unusual in this respect; crosses between races of other pines—and most other plants—generally yield large numbers of offspring.

The closed-cone pines are not confined to California; there are several species native to Mexico. We have not been very successful in crossing the California species with the Mexican species. The sole product of these crosses so far is a single young hybrid of Mexecan weeping pine *(P. patula)* and Monterey pine. It seems that these two groups of closed-cone pines are not nearly as closely related as are the yellow pines of the western United States and those of Mexico.

These are but some of the many interesting aspects of breeding and crossing of our western pines. Additional information on these and other pine hybrids at the Institute of Forest Genetics can be found in the following publications:

Critchfield, William B. 1963. Hybridization of the southern pines in California. Forest Genetics Workshop, Proc. 1962: 40-48. (So. Forest Tree Improvement Com. Pub. 22, Macon, Ga.)

1966. Crossability and relationships of the California big-cone pines. U.S. Forest Serv. Res. Paper NC-6,

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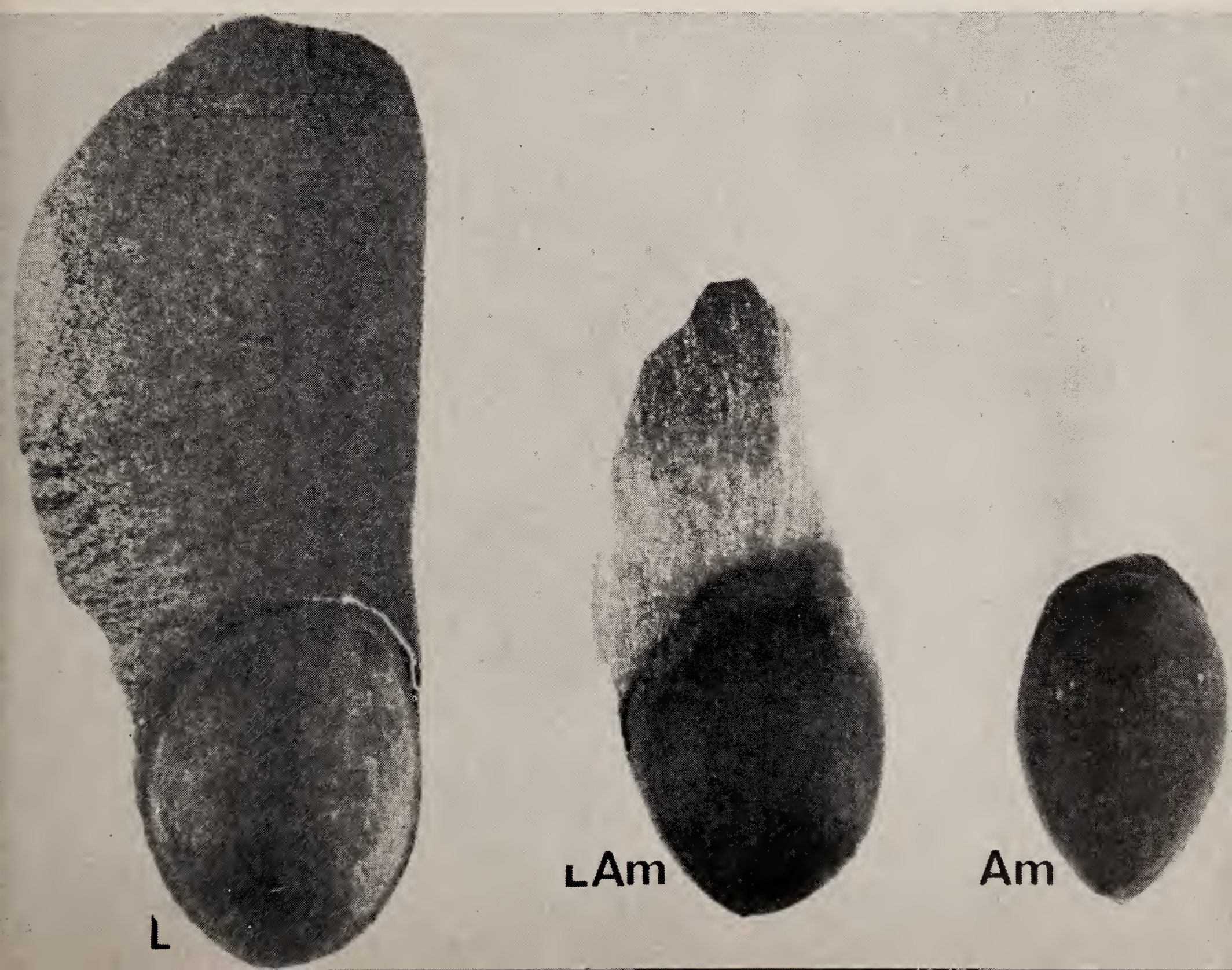
Below—
The seed of sugar pine (L) has a well-developed wing, while Armand pine (Am) has an essentially wingless seed. The hybrid (LAm) however, has a seed wing mostly ragged in appearance and highly varied in shape.

Photo: Courtesy Institute of Forest Genetics, Placerville, Calif.
Fig. 16



Symposium on the Biology of Woody Plants; Nitra, Czechoslovakia

Brian O. Mulligan

During March 1966 I received notice of this proposed Symposium, being organized by the Arboretum Mlynany ("Milynany") near Nitra, in Slovakia, to be held in the new University of Agriculture in that town to celebrate the 75th anniversary of the founding of this well known European arboretum. The planned program was divided into five sections dealing with different aspects of woody plants and their cultivation: (a) Systems and Morphology; (b) Physiology and Biochemistry; (c) Genetics and Improvement; (d) Ecology and Introduction, and (e) Organization and Aims of Arboreta and Botanical Gardens.

It occurred to me that perhaps we might have something to offer in the last section, so I made a request to the Dean of the College of Forestry to attend and participate in this international meeting. In due course this was granted.

Soon afterwards I learned that the International Dendrology Society, of which I am a member, was arranging a tour in southern Jugoslavia in June 1967 to see the native trees and forests, so I made a further application to the College of Forestry to extend my time and travels to include this most interesting proposal. Happily for me, and I hope others also, this was likewise approved, and I proceeded with the necessary travel plans, particularly to obtain the essential visas for the central European countries involved—Czechoslovakia, Poland and Hungary—and to make reservations for flights between various cities and in several hotels.

Since there was a period of eighteen days between the meeting at Nitra and the I.D.S. tour starting at Dubrovnick I decided to fill this by visiting important arboreta or botanical gardens in the countries mentioned, with which our Arboretum had been exchanging seeds and in some cases plant material for many years. This tour included Brno in Czechoslovakia, Warsaw and Poznan in Poland, Budapest in Hungary, and Zagreb in northern Jugoslavia; it will be covered in a later installment of this record. The present account only deals with the meeting in Czechoslovakia.

I left Seattle for Vancouver, B.C. by air on Friday morning, May 5, and departed Vancouver 3:45 p.m., 1-1/4 hours behind schedule. We stopped at both Calgary and Edmonton, Alberta, then flew non-stop to Amsterdam, over central Greenland and well to the north of Iceland (to 73° N.). The pack ice floating on the sea east of Greenland could be clearly seen from the 'plane's window! We landed in Amsterdam, where it was raining, at 11:10 a.m. European time. I spent the rest of the day and that night there, then took off for Prague, Czechoslovakia, next afternoon, 1:45 p.m. in a Hungarian Air Lines (Malev) four-engined prop-jet. This non-stop flight took about 2-1/2 hours. Prague was distinctly sunnier and warmer than Amsterdam. We drove along several miles of a boulevard lined with flourishing linden trees, probably both *Tilia platyphyllos* and *T. tomentosa* in different sections, to the city's outskirts—a pleasant change from some other similar approaches to cities one could think of, in several countries.

I stayed two nights at the Alcron Hotel, which still holds its prewar reputation for food and comfort. On Monday 8th, which was a public holiday, I was very kindly taken by Mr. Milan Blasek out to the Botanical Garden of the Academy of Sciences at Pruhonice, formerly the estate of Count A. Silva-Tarouca who lived there and directed its development from 1885 to 1936. The present Director is Prof. Dr. A. M. Svoboda. The park covers about 600 acres, and includes an arboretum with some

magnificent specimen trees, especially of spruces (*Picea abies* and *P. pungens* 'Glauca') and European beech, both green and purple leaved. *Picea breweriana* from the Siskiyou mountains was approximately 20 feet tall. *Rhododendron* 'Cunningham's White' was planted in groups beneath oaks (*Quercu robur*) and in flower was very decorative (fig. 17).

One notable feature was a natural rock garden occupying what was almost a cliff perhaps 50 feet high above a small river. *Phlox subulata* and deep blue *Gentiana angustifolia* were flowering profusely, and there were many other choice rock plants including small conifers. Elsewhere was a collection of *Rosa* species, of garden roses, of *Iris*, both species and garden forms, and of fruit trees for experimental purposes. Mr. Blasek is engaged in collecting, selecting, breeding and studying the wild native irises of central and southern Europe. There is also a very large collection of conifer cones in one of the offices, formed by M. Kucera, to which our Arboretum has contributed.

During the afternoon we visited the estate and castle of Konopiste, where there are also large specimen trees, but in smaller variety. *Picea omorika,* 50 feet tall with two trunks was remarkable, and our native *Chamaecyparis nootkatensis* had reached the same height. I was surprised to see another native tree, *Tsuga mertensiana,* about 13 feet tall but evidently of some age.

The castle possesses a phenomenal collection of hunting trophies, weapons and armour, assembled by the Archduke Ferdinand of Austria, assassinated at Sarajevo, July 1914.

Next morning Mr. Blasek showed me some of the parks in Prague, including the famous Mala Strana terrace gardens above

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Below—
Pruhonice Castle, near Prague, Czechoslovakia. Entrance driveway, with *Magnolia Soulangiana* forms.
Fig. 17 Photo by: B. O. Mulligan

the river Vltava, quite Italian in style, warm in the morning sunshine. We lunched in an attractive small restaurant close to St. Vitus' Cathedral, which possessed a vaulted roof like a crypt, the walls painted white. Lilacs were in full bloom everywhere and form a prominent feature in many small gardens in central Europe, being often used for hedges or screening purposes.

Soon after 3:00 p.m. I was back at the airport by 'bus, to catch the 4:00 p.m. 'plane for Bratislava, a twin-engined propellor driven type, which, however, provided a pleasant hour's flight. At the airport I was delighted to see Mr. A. M. S. Hanan and Mr. Aidan Brady from Dublin, also en route to the meeting, so I could converse easily once again.

In Bratislava we were surprised and pleased to find a car waiting for us, with a chauffeur and a warm welcome from Dr. F. Botka, personal assistant to Mr. F. Bencat, Director of the Arboretum Mlynany. This was an unexpected courtesy and assistance, since it is sixty miles from Bratislava to Nitra and we should otherwise probably have had to find a bus.

International Symposium on the Biology of Woody Plants

Approximately 160 representatives of arboreta and botanical gardens, from fifteen different nations, attended this Symposium. More than half the total came from Czechoslovakia, forty delegates from all parts of the U.S.S.R., many others from central or southeastern but very few from western Europe or from other continents. Ireland was represented by Messrs. A.M.S. Hanan and Aidan Brady, Belgium by Dr. W. Robyns, Holland by Prof. J. Lanjouw, Sweden by two, India by at least one delegate,

Below—

Part of the University of Agriculture, Nitra, Czechoslovakia, where Symposium took place. Great Hall in center.
Photo by: Dr. P. A. Lapin (Moscow Botanical Garden) Fig. 18

the U.S.A. by myself, but England, Scotland, France and Canada sent no one.

Participants assembled at Nitra on May 9th and 10th. Members were housed either in the two hotels in the town, neither of which was at all modern in any respect, or in students' rooms at the University. Meals were available at the latter during certain hours, or at the hotels.

The University is quite new, some of the buildings having been open for two or three years, others still under construction. The architecture is simple, attractive, and apparently functional. The formal inauguration took place on May 10, at 5:00 p.m. in the Great Hall, a circular domed building seating perhaps 750 persons; about 200-250 were present on this occasion. The inaugural speech was given by the Vice-President of the Slovak Academy of Sciences, D. Blaskovic, who was followed by the scientific head secretary of the Academy and the principal guests, including Dr. P. I. Lapin from Moscow, Prof. Lanjouw, Dr. Robyns and myself. I read congratulatory letters from the International Dendrology Society and the American Association of Botanic Gardens and Arboretums, both of which groups I was representing. A lecture was then given by the rector of the University of Agriculture at Brno, Czechoslovakia, on *Dendrological Research in Czechoslovakia.* All speeches were immediately translated into English, German and Russian, receiving sets being available for those who required them. A musical program with orchestra and singers succeeded the lecture for half an hour.

In the evening a dinner followed by a reception was held in the University students dining room. No formal toasts were drunk, but many informally, the Vice-President of the Academy mixing freely and cordially with his guests.

Symposium meetings took place on May 11, 12, and 13, both mornings and afternoons (without coffee breaks!), in three sections, each occupying a separate lecture hall fitted with translating and receiving equipment and facilities for showing slides. Most of the meetings I attended were in Section C:—Ecology and Introduction of Trees (fig. 18).

The simultaneous translation systems were handicapped by the translators' booths being too near each other and insufficiently insulated, so that there was interference between the different voices and languages. It will be more instructive to read the various papers when published, which it is to be hoped will also be in the same languages. A very wide variety of subjects was covered, as can be imagined with so many authors from fifteen countries. More than 90 papers were on the program, although not all were read, and undoubtedly much new and valuable information on woody plants and their behavior should then become available. Prior to the Symposium a paper-covered book of 572 pages summarizing in four languages all the papers to be presented was distributed to those registered. On the evening of May 12 a concert lasting 2-1/2 hours was given for the benefit of those attending by the Nitra Teachers Choir, comprising seventeen men and thirty women. This was an unexpected pleasure to all of us.

On Sunday, May 14 the first excursion took place, delegates having a choice of four places. I went to the poplar research station at Gabcikovo, near the Danube river south of Bratislava, from which we were taken to see the large stands of poplars adjacent to it or on islands. *Populus* 'Marilandica', *P. X robusta* and the Italian hybrid I 214 seemed to be the most satisfactory. *Salix alba* was also frequently used and grew to a large size.

That same afternoon we proceeded to the Arboretum Mlynany, about fifteen miles east of Nitra, for further ceremonies in honor of its founder, Count Ambrozy-Migazzi, including the unveiling of a bronze bust in the garden adjacent to the house. A large crowd was present, including the late Count's daughter and many of the local inhabitants. In the evening a remarkable picnic supper took place in one

(Continued on Page 96)

Seed Germination

H. M. Butterfield*

The principles and practice of seed germinations are of great practical importance to plant propagators. A review of some of the essentials will be given here, and a few definitions that may help others to understand the discussion and directions.

Definitions

A *seed* is a fertilized and ripened ovule, usually in a resting stage. The *ovule* contains an egg nucleus, in a so-called embryo sac, and other essential parts that ultimately produce a healthy seedling. When viable pollen which has an affinity for the species and variety being pollinated reaches the receptive stigma of the flower, a pollen tube will be formed that pushes its way down to the ovary. The pollen tube contains two sperm nuclei. One of these unites with the egg nucleus; and this fertilized egg then divides repeatedly to form an embryo, and seed development follows. The other sperm nucleus fuses with another nucleus in the embryo sac; and the product of this fusion divides to form the endosperm.

There are many causes of faulty natural pollination in plants, and artificial pollinators may have to be available at the proper time. Insects and wind may help carry viable pollen to the stigmas. In the case of certain selected and cultivated varieties, such as the avocado, the stigma may be receptive at a time when the parent tree is not shedding pollen or the parent plant may be shedding pollen when the flowers are not receptive to pollen. The stigma normally forms a sticky, sugary material in which the pollen grains can germinate and push on down through the style to reach the ovary and bring about fertilization of the egg. There must be a proper affinity between the pollen plant and the seed parent. When listing the parents of artificial crosses, it is customary to list the seed parent first and the pollen parent next. Date of pollination should always be recorded when known.

In the case of citrus seeds, and a few other plants, normal pollination which sets up embryo development through the sexual process may be accompanied by the formation of embryos which develop by budding of material tissue into the embryo-sac. Seedlings developed from such embryos are genetically the same as the mother or seed parent. These embryos which are not the direct result of pollination may require the stimulation of normal pollination to start forming but are asexual in nature. This poses a problem when it is desired to combine the characters of two varieties or species.

The plant breeder may also find that pollination has taken place within the flower before the petals open. The breeder gets around this trouble by emasculating the flowers, that is, removing the anthers, well before any pollen has been shed. Prior to and following hand pollination, the flower is "bagged" to prevent any other pollen from reaching the hand-pollinated flower.

Seed Condition

Seeds need to be handled carefully to avoid damage to the embryo. Rough handling at threshing time can result in a lower percentage of germination. Rains or excessive moisture at the time of harvest cause trouble, whereas a long dry season at time of harvest favors a much higher grade of seed. Keeping seed in a plastic bag while there is still too much moisture can result in mildewing and rapid deterioration. Consequently seeds should be dried before storage in dry-air containers. It may help some to keep the seed cool at 35 to 40° F. during storage, or else plant

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*Reprinted from the California Horticultural Journal, April 1967—with kind permission of the Author and Editor.

promptly, as in the case of rose seed, oak acorns, or maple seeds, and various other seeds that have a short life. In all cases there must be a mature embryo inside the seed coat if germination is to take place. Cracking a few seeds will usually show if the seed has filled out properly. There are state and federal laws which set germination standards for many field seeds being shipped, so the buyer will know that their germination percentage will be reasonably good. Most reliable dealers destroy seeds that have deteriorated. Actual tests are made at intervals to insure a good percentage of germination.

Germination refers to the planting of seed and the resumption of growth causing seedlings to appear. In some cases it is difficult to break the rest period. The seed may remain alive for months or years until the proper conditions appear and overcome the block. Many seeds will germinate in a week or two or three weeks, but some seeds may take weeks or even years until barriers to germination are removed. Methods for avoiding or breaking the blocks will be discussed later.

Kinds of Seeds

Seeds have been classified in various ways with the hope that the proper method for germination can be selected. Seeds may come from a temperate zone or from the tropics, or possibly from the dry desert. Seeds may be starchy, proteinaceous, or fatty. The longevity may be known or estimated. Certainly the propagator would like to know approximately when germination can be expected after planting. If special treatment has been given the seed, then the period for germination is counted from the time of planting to germination. The great majority of popular flower seeds will require only a week or two or a month at most to germinate. Some seeds of woody plants take more time. Some of the seeds that may take 60 days for germination include: Species *Arbutus, Berberis, Carpenteria,* some *Ceanothus, Cercis, Cornus, Dendromecon, Rhamnus crocea,* and Matilija poppy *(Romneya coulter.)* Seeds of *Garrya elliptica* and *Platanus* may need as much as 135 days to germinate.

Seed Longevity

Most seeds of ornamental plants remain viable for at least three to five years, and some longer. Tests for seed-longevity were conducted by the Seed Laboratory of the California State Department of Agriculture over a period of ten years. In most cases seed should be fresh to germinate well, but some extremely long lives have been reported by the *Gardener's Chronicle* of London and by the Royal Botanical Gardens at Kew. *Albizzia julibrissin* seed germinated after 149 years. Seeds of *Cytisus* and some other legumes germinated after 80 years or more. Lotus *(Nelumbo nucifera)* seeds from Manchurian peat deposits germinated after 850 to 1250 years, according to a test by the residual carbon 14 isotope method. But the "Mummy" seed, of wheat and peas, from Egyptian tombs was dead in all authentic tests and soon disintegrated. Generally, there is little use in trying to hold seeds for a long time.

Special Germination Habits

Occasionally a species may have some peculiar germination habits. The seeds of the peonies when planted will form a root and then become dormant before the shoot (epicotyl) starts to grow. After a rest period, the shoot will start to grow and reach the surface. A failure to know about such a peculiarity might lead to the assumption that the seed was not viable.

Seeds of some hybrid irises and lilies have failed to germinate when the endosperm remained. By separating the embryo from the endosperm and culturing the embryo in the Randolph-Cox culture medium, breeders have been successful in germinating such seedlings. Even seeds of some common bearded irises may take more than

a year to germinate if not planted when fresh and not kept too dry.

Light and Dark

Most popular flowers seeds germinate well at a temperature of 65 to 70° especially if there is some alternation of day and night temperatures. But some seeds need to be exposed to light to break the rest period. In some seeds investigators have found a pigment which affects the germination according to the wave-length at which it is illuminated. A propagator handling lettuce seed should know that red light is most effective in germinating this seed. Other seeds may respond to far-red light. Often, only a very low light intensity is needed to affect seed germination; however, it has been observed that birch seed has failed to germinate under a canopy of leaves in the forest, whereas, the same seed germinated well in an open area.

Desert Seeds

Many wildflower lovers have noticed that desert flowers appear at their best in seasons with copious, early rains. The seeds remain dormant for several years or until a season with heavy rains comes along. In some way the heavy rains wash away the inhibitor and then germination takes place. Whatever the inhibitor is, it is not much affected by scanty rain. Usually, however, there will be enough seed that does not germinate left in the soil to maintain the stand of the wildflowers, even if the new crop of plants should fail to mature.

Special Kinds of Seed Treatment

Propagators have tried to find out what kinds of seed treatment will help break the dormancy of seeds, especially seeds with hard or oily seed coats. The treatments include seed *stratification, hot water treatment, acid bath,* and *scarification,* or a combination of these. But readers should be reminded that there may be very complex organic substances and unknown processes that affect germination. We do know something about the subject, but further study is needed to learn more about the causes of delayed germination.

Seed Stratification

Seeds in the temperate zones of the world often remain covered with humus for weeks or months and are subjected to chilling temperatures which help break the rest period. The propagator may likewise use artificial stratification to hasten seed germination. Sand, peat, sphagnum moss, and other materials have been used in which to stratify the seeds for chilling. Layers of nuts or seeds may be placed in a container and chilled to hasten seed germination. The initial temperature for chilling is about 35 to 40° F. The stratification medium is kept barely moist during the period of chilling. After about two and one-half to three months the seed with container may be removed to room temperature (65 to 70° F.); and then, germination will often take place in a few days or weeks, depending on how old the seed is or on the hardness of the seed coat. Once the seeds start to germinate, they can be lined out in a nursery row. On a small scale, the seeds may be planted in the usual way in a pot, and then the pot held in cold storage as suggested above. When removed to room temperature, germination should take place without having to disturb the seed.

Hot Water Treatment

Seeds with a hard or oily seed coat will sometimes germinate more readily after treating with hot water. The water is heated in a pan to 180° F., then removed from the fire, and the seeds dropped in so they can soak for 12 hours over night. Some legume seeds respond very well to this hot water treatment.

Acid Bath Treatment

Seeds with a very hard or oily seed coat

(Continued on Page 94)

Marckworth Forest Dedication

Public ceremonies on May 20, 1967 marked the dedication of the Gordon D. Marckworth Forest as the newest forestry education and research facility of the University of Washington. More than 150 of the state's top land management executives and forestry educators attended the dedication of the 6900-acre tract, named in honor of the Dean Emeritus of the University of Washington College of Forest Resources.

Dr. Solomon Katz, University of Washington Provost, and Dean James Bethel, College of Forest Resources, spoke on behalf of the school's participation in the joint venture in land management research. Bert L. Cole, Commissioner of Public Lands, made the dedicatory address and performed the official act of transferring the land-use agreement contract to University custody.

Mr. Cole emphasized the dedication of the forest to Dean Emeritus Marckworth in recognition of his nearly thirty-year career at the University continued an education program which would help to increase future productivity of the state's outstanding renewable natural resource.

In his response to the dedicatory program, Dean Marckworth noted his gratitude for the living, growing memorial named in his honor and the opportunity to continue to serve in an educational effort of increasing value and inspiration to succeeding generations. Among his brief comments, he recalled his long association with forestry agencies in the Pacific Northwest and with his past students, many of whom were present for the occasion.

Dean Marckworth's career in forestry has been long and distinguished. Commencing with his graduation with a Master's degree from Yale University in 1917, he became Assistant State Forester in Virginia. Following this position, he was appointed Professor Forestry and Head of the Forestry Department at Louisiana State University in 1925. In 1931, he became Dean of the University of Georgia School of Forestry. Eight years later, in 1939, he joined the University of Washington faculty as Professor of Forestry Management. He was appointed Dean of the College of Forestry in 1945 and served in that position until his retirement as Dean in 1963. On July 1, 1965 he retired from the University and was appointed Dean Emeritus of the College of Forestry.

The excellence and wide range of interests of Dean Marckworth's services and accomplishments during the nearly thirty years he has been in this state are exemplified by his presidency of the Washington Forestry Conference and his election as an honorary lifetime trustee of the Keep Washington Green Association. He has been listed in "Who's Who in America", "Who's Who in the West", and "American Men in Science". State legislators and forest products executives attribute the updating of forestry laws and practices to his research and counsel.

The College's new experimental forest is located approximately 18 miles east of Bothell at the junction of the Cherry Valley and the Youngs River (Sultan) truck trails. The 6900-acre tract comprising the research and education area is characterized by forty-year old stands of Douglas fir, western hemlock, western red cedar and red alder, typical of substantial forest acreage in western Washington.

The close-in location of the forest tract and its wide variety of soil conditions make the Marckworth Forest an ideal site for research and teaching activities which concern the second-growth economy of the forest products industry of the state. Forest protection studies, recreational demand

(Continued on Page 92)

*Reprinted with kind permission from the Washington Forester Alumni Newsletter, August 1967. (We know our readers will be delighted to hear of this fine honor bestowed upon *"Our Editor"*—G.W.)

The Arboretum Bulletin

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SPECIAL NOTICE

To keep membership in the Arboretum Foundation in good standing, dues should be paid during the month payable. Active memberships more than three months in arrears will be dropped and The Bulletin will be discontinued.

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I hereby apply for membership in the Arboretum Foundation and remittance for same is enclosed to cover dues for the next succeeding 12 months.

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All memberships are non-assessable.

Mrs. John Minor Blackford

The many Arboretum members who have visited Mrs. Blackford's beautiful woodland garden on Mercer Island in the past 17 years were saddened to learn of her several months illness and subsequent passing on July 14th. She had been an active member of the Arboretum Foundation for 30 years and some of the happiest hours of her later years were spent personally conducting Arboretum Unit groups through her self-landscaped and maintained "paradise". The tours both morning and afternoons during April and May were so popular it was often necessary to make a reservation a year ahead.

Mrs. Blackford was an ardent conservationist and was horrified at the way the modern bulldozers are destroying beautifully wooded areas. She loved our own Pacific-Northwest natives and felt they were among the finest in the world. Consequently she left half of her 4 wooded acres in its native state; interplanting the rest with over 2,000 species and hybird rhododrendrons, azaleas and other ericaeceous plants. Hundreds of these she had raised from seeds or cuttings many coming from Mrs. R. C. Frye's famous collection. One of the outstanding features of her garden was the extensive use of groundcovers, both our native and eastern varities.

In the process of organizing a new Arboretum unit, the trip to Mrs. Blackford's garden was an inspiring high-light of the "indoctrination". It often helped the decision to join, for this sprightly 80 year old lady's contagious enthusiasm for the garden she had started over 20 years before, and still maintained, made their garden dreams seem possible. Until her last illness she continued to "dead-head" all her rhododendrons and azaleas herself and even moved the primroses when through blooming to the "kitchen garden," replanting them back to the border in the fall.

Mrs. Blackford not only shared her gar-

den, but her hospitality extended to her charming heirloom filled cottage, for she often invited the group to have tea with her, homebaked bread sandwiches and cookies. She gave most generously of plants and cuttings to the Arboretum and to anyone who showed an especial interest in certain plants, so, many of her treasures will live on in our gardens in remembrance of this remarkable woman. Her name will be perpetuated in the "Elizabeth Blackford" Arboretum unit and in the pink azaleadendron which the late Endre Ostbo hybridized and named for her. She was a witty, gracious southern lady who did much to create enthusiasm for gardening. The Arboretum will miss her keen interest in it, but we are all much richer for her having been a part of our community.

Myrtle De Friel

THE PLANT SALE

Each year, for twenty years now, the Unit Council of the Arboretum Foundation has held a plant sale to raise money for its programs to support the University of Washington Arboretum. It is the only all-Unit money raising function for the organization and innumerable members are involved in one phase of it or another. The success of a sale is measured by new friends made (human and botanical), knowledge accrued and dispensed, plants acquired and dispersed, interests stimulated, local nurseries supported, donations shared, a spirit of service given to the Arboretum, as well as profits. We are happy to announce that we made approximately $6,900.00. This amount would be impossible to attain without the support of so many friends and the Plant Sale Committee wishes to thank you all!!

This is your Arboretum, kept alive by your support

We are pleased to welcome the following new members (August 11 through November 30, 1967): *Sustaining*—Island Park Garden Club, Mrs. Jeanette Patterson. *Annual*—Mrs. J. Accurso, Mrs. Arthur J. Amende, Mrs. Albert W. Bailey, Mrs. Angela E. Behrent, Mrs. G. L. Bereman, Mrs. Claude H. Bertheas, Mrs. Carole M. Bissel, Mrs. Robert M. Blumenthal, Mrs. Donald Boyd, Agnes Brockmier, Mrs. Robert B. Broswick, Mr. & Mrs. Albert L. Brown, Mrs. Robert G. Bruland, Mrs. Joel Buxbaum, Mrs. L. T. Campbell, Mrs. Phyllis Chilton, Frank M. Clement, Mrs. John B. Cutting, Mrs. Al F. DeYoung, Mrs. George H. Dodge, Mrs. Don M. Drury, Mrs. Mikal Dyrnes, Mrs. Eilert J. Eliasen, Mrs. Lowell D. Erickson, Mrs. Bruce M. Fleming, Mrs. C. E. Flory, Mrs. Gregory Foster, Mrs. Wheeler Grey, Jr., George Harrison, Mrs. Calvin D. Hazelet, Mr. & Mrs. Elwood D. Hogan, Mrs. G. W. Hufschmidt, Mary Frances Humphrey, Mrs. James Frank Ingram, Mrs. Dieter Jahns, Mrs. Roger C. Jenkins, A. P. Johnson, Mrs. Fordham L. Johnson, Mrs. G. Robert Johnson, Mrs. Lewis Johnson, Mrs. James W. Johnston, Mrs. A. O. Kalkoske, Mrs. C. Edward Kovacs, Mrs. Ivan O. Kullmann, Mrs. Robert Langlow, Mrs. Thomas C. Lovitt, Mrs. R. W. Maider, Mrs. Robert B. Mason, Mrs. Michael P. Miller, Mrs. John M. Nelson, Mrs. Ruth Nichols, Mrs. Joseph C. Olsen, Mrs. W. J. Pennington, Mrs. Stanford C. Pilet, Mrs. Walter Rasmussen, Mrs. George E. Reed, Mrs. Richard F. Robertson, Mrs. Gene P. Robinson, Mrs. C. J. Rostykus, Mrs. Allan N. Rumpf, Mrs. George B. Ryan, Mrs. Robert C. Samuels, Mrs. Robert H. Schreibe, Mrs. Elias M. Solomon, Mrs. John T. Storz, Mrs. Ken Swensson, Mrs. Samuel H. Tarica, Mrs. Arthur R. Taylor, Mrs. Paul Thienes, Mrs. Paul Van Leunen, Miss Cynthia Wagner, Mrs. Phoebe L. Wagner, Mrs. Norman E. Weitkamp, Mrs. Herbert R. Welsh, Mrs. Alan Yeoman.

We are also grateful to the following who have increased their membership dues to: *Sustaining*—Mrs. Bert A. Eyer, Mr. & Mrs. John Putnam, Newell F. Varey, Mrs. G. A. Wilson.

Some of Our Favorites ☆

☆ *Won't You Send Us Yours?*

Iris cristata

Some of the oldest residents of my garden are presently little brown and green striped humps, resembling hardy fat caterpillars. Recently they were clumps of bright yellow leaves, 5-ft. tall and, adding a low splash of color to our gaudy autumn garden. One of my favorite plants, *Iris cristata*, was a gift years ago from my favorite gardening friend. Each spring they delight me with numerous delicate blossoms, perfect miniatures on 4-in. stems. The flowers are almost flat, lavendar with white patch and yellow crest, the distinguishing mark of the crested or Evansia group of iris. The white forms are generally less vigorous.

Iris cristata is native to Appalachia and is generally found in cool moist areas, associated with ferns, mosses and violets. All directions I have discovered urge that they be grown in half shade in moist, gritty soil. I have also heard several local gardeners say their blooms are scarce. In my new garden I had no half shade, so I planted them on a steep slope that, though facing north, gets the blazing summer sun of our hilltop, and a good share of our summer water bill—and they are thriving. With faithful aplications of slug bait, I get a good crop of blossoms, starting in April, a few continuing to appear through the spring months.

It is recommended that the clumps be increased immediately after blooming when new roots are being formed. Cut off the extra "'caterpillars' without disturbing the rest of the clump. After replanting, (I suggest in a sunny spot) keep the rhizomes moist until established. A little snip can be tucked into so many spots in a garden and will quickly grow into a clump of smooth, graceful leaves, a perfect contrast, in just the right scale, to the heavier texture of low rhododendrons and small ferns. They are also an unusual and handsome splash of autumn yellow in the rock garden. I find it very difficult to be generous with my supply of my precious *Iris cristata*—why they even rarely need to be dug up and divided!

Mrs. Allen D. Moses

Marckworth Forest Dedication

(Continued from Page 89)

evaluations, determination of best techniques for harvesting, and surveys of available markets for second-growth trees will initiate the first stage of research.

Future plans for the Marckworth Forest include advanced studies extending research programs already underway and building on known forestry data previously recorded by school, industry, and agency researchers. The earliest research at the Forest will be a study of *Fomes annosus* infestation in hemlock stands.

Other forest protection projects are scheduled, as well as investigations and demonstrations in Outdoor Recreation, Silviculture, and Timber Harvesting.

Crossing the Western Pines

(Continued from Page 81)

N. Central Forest Exp. Sta., St. Paul, Minn. pp. 36-44.

1967. Crossability and relationships of the closed-cone pines. Silvae Genetica 16(3): 89-97.

Duffield, J. W. 1952. Relationships and species hybridization in genus *Pinus*. Ztschr. f. Forstg. u. Forst pflanzena. 1 (4): 93-97.

Little, E. L., Jr. and F. I. Righter 1965. Botanical description of forty artificial pine hybrids. U.S. Dept. Agr. Tech. Bull. 1345, 47 pp.

BOOK REVIEWS

Irish Gardens by Edward Hyams and William MacQuitty. The Macmillan Co., N.Y., 1967. Price $17.50.

This is a large and impressive looking book with the text by Edward Hyams, the well-known English writer and garden authority, and well illustrated with William MacQuitty's excellent photographs—including fifteen color plates.

The first chapter on "Origins of the Irish Garden" is wonderfully interesting and informative. Edward Hyams has a vast knowledge of the factors and styles that influenced Irish gardens, from early Roman times through the 17th Century Italianate and 18th Century English landscape styles, down through the late 19th and early 20th Centuries, so greatly influenced by that remarkable gardener, William Robinson. Fourteen gardens are described in detail, each with its own well-illustrated chapter, plus Glasnevin, the National Botanic Garden of Dublin.

Blessed as they are with the advantage of the Gulf Stream and a climate that gives ample rainfall, usually mild winters and in the main, good soil, these gardens are able to have more tender and sub-tropical plantings than would be possible in areas with similar latitudes.

Despite the shelter plantings and high walls common to most of these gardens, some are exposed to the strong Atlantic winds, and these gales take their toll, but the beautiful, tall tree ferns from New Zealand and Australia continue to flourish and are especially outstanding at Rossdohan, in County Kerry.

All of these gardens are on a large scale. Most of them contain several styles of garden architecture, such as Ilnacullin with its formal Italian gardens designed by H. A. Peto. Mount Stewart, in County Down, containing every major gardening style, is full of exotic plantings, fantastic statuary, and some elaborate topiary work depicting a hunting scene.

The well-known gardens of Powerscourt offer an impressive view of the Wicklow hills and Sugar Loaf mountain from the formal terraces that stretch out to a great circular pond, but natural woodland areas are also included with a fine speciman of **Abies procera** from Oregon.

An interesting note on the Ardsallagh gardens in County Tipperary: though most of Ireland has acid soil, this garden is on limestone, and the owner has made raised beds of peat above the surrounding ground level so that no water containing lime reaches into them. Thus rhododendrons and other acid loving plants are happy and thrive there.

One of the main charms of these gardens is the skill with which exotic and rare specimens from other countries have been grouped and planted to mingle harmoniously with the native and more well-known material, so that all parts blend naturally together to make up the whole, and there is no feeling of viewing just a collection of botanical specimens.

To maintain these great and historical gardens with their wonderful collections would be well-night impossible in our modern economy, and many of them have been handed over to the National Trust of Northern Ireland, thus ensuring their preservation. But some are still privately owned. Mount Usher, in County Wicklow, is an example of this, and is still being maintained by the Walpole family (the 5th generation to do so). The author considers this "the most nearly perfect example of the romantic, paradise garden", and surely it deserves this distinction. Though like all gardens it must be beautiful in spring with its many flowering shrubs, it is no less lovely in the fall. With the river Vartry flowing through the garden, the fall color of the maples and swamp cypress, plus **Eucryphia cordifolia** in full bloom, it is a signh worth seeing.

This book with its detailed descriptions and many pictures would spark a desire in any gardener to see these lovely spots if one had never been there, and a return visit if one had. Surely the spectacle of eighty **Magnolia Campbellii** in full bloom, as planted along the river walk in the Mount Congreve gardens near Waterford, would alone be worth the trip!

Alice Hayter

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Seed Germination

(Continued from Page 89)

may be treated in an acid bath to hasten germination. Sulfuric acid, technical grade, with a specific gravity of 1.84 has been used. A glass jar with perforated lid is used to hold the acid. The user should protect his eyes with goggles and hands with rubber gloves, because the acid can spatter when it comes in contact with water. Mixing of the acid with water should be done very gradually by *pouring the acid very slowly into the water* (not vice-versa!) The volume of acid should be about twice that of the seed to be treated. The seed should be dry when covered with the acid. Allow the seed to remain in the acid for one to four hours or more, according to the kind of seed and how old it is. At the end of the acid-bath, pour off the acid and save it for future use. Introduce a small rubber hose through the perforated lid, and gently run water on the seed for about two hours. Finally, after about two hours of washing with water, drain the seed and add a teaspoon of washing-soda for each quart of contents, to neutralize any remaining acid. When bubbling in the water stops, wash well and drain. The seed in then ready for planting.

To give some idea of how seeds respond, it may be reported that *Rhus ovata* seed has to be treated for one to six hours. *Rhus integrifolia* has been kept in the acid bath for four hours. *Cornus nuttallii* has been kept in the acid bath for four hours and then stratified for three months. *Symphoricarpus albus* seed germinated best after being in the acid bath one hour, then stratified for six months. These tests reported by N. Mirov show to what extremes a propagator will go to find a suitable method for germinating seeds.

Scarification

Where the seed coat is hard and moisture cannot penetrate the embryo, the seed coat may be chipped with a knife, scarified with sand, or rubbed with sandpaper. Sometimes the seed has to be cracked, but great care is needed to avoid any damage to the embryo within. Some legumes lend themselves nicely to scarification on a commercial scale. Thus, clovers used in field culture have been scarified to improve germination. *Cytisus scoparius* seed may also be scarified to hasten germination. Two hours in a good sand scarified drum should be adequate for large-scale treatment.

Control of Damping-Off

The propagator may be frustrated in getting seed to germinate without damage from certain soil fungi, commonly referred to as "damping-off" fungi. Fungi may kill the seedling before it emerges (pre-emergence damping-off) or may destroy the seedling tissus near the ground level soon after the seedling emerges. (Post-emergence damping-off). If seedlings are planted too closely, or the soil surface is kept extremely wet, or the temperature is too low, a fungus may ruin a whole planting. By partial sterilization of the planting medium and regulation of the soil moisture and soil temperature, this danger can be greatly reduced. There are soil drenches which are effective in preventing and arresting this fungus.

The writer has successfully used boiling water to treat the planting medium used for seeding, also sand covering. This is only partial soil sterilization, but it helps.

Chopped sphagnum moss, run through a sieve with three meshes to the inch, has

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helped prevent damping-off fungus from growing around seedlings. This chopped sphagnum moss may be used to fill a planting container or to top the soil in the container. Seed is planted directly in this moss and watered without any sterilization.

Nutrient Agar as a Planting Medium

Sterilized nutrient agar has been used to germinate orchid seeds. The Knudsen formula is one commonly used for germinating orchid seeds. A similar agar formula has been used to germinate small seeds, such as those of azaleas and rhododendrons. The Randolph-Cox agar formula has already been mentioned for germinating iris embryos. A nutrient solution has been used to float fern spores for germination.

Germinating Unusual or Unidentified Seeds

When a propagator is asked to germinate unidentified seed or seeds with unknown requirements, he does the best he can, having a guess at the best methods to use. Recently the writer was asked to germinate seeds of what may be *Echeveria bicolor* from Venezuela. The collector found the plants growing near orchids, mosses, and ferns at an elevation of about 5,000 feet on Mount Avila, five miles from Caracas in a rain forest area. With this bit of information and with over 25 years of experience in germinating *Echeveria seeds*, I made a good potting soil in a clay pot, and the top inch or so was screened to remove any lumps or hard materials. The planting medium was firmed and made level, then covered with a paper towel. Boiling water was poured over the surface and allowed to run through the drainage hole. The paper towel was used to keep the surface level and smooth. As soon as the soil had cooled, the seed was planted and barely covered with No. 4 sand, then the planted seed was drenched with a mist spray of water. The pot was covered with glass and kept warm at about 65 to 70° F. Daily application of a mist spray of water was given. Thus, the growing conditions were similar to those existing on the tropical mountain. The small seedlings began to show on the eighth day and many more appeared on the ninth day. Evidently this home method worked very well for germinating the very small seeds. On another occasion the writer was handed a large seed from a tropical plant in Honolulu and asked to try to germinate it. The seed had been found on the ground in a park. Was it from a tropical shrub, tree, or vine? The seed had been carried around for about 11 years. Would it germinate? I looked at the seed and believed it was an oily one, and so treated it with hot water at 180° F. The seed was planted at a depth of about one-quarter inch. In about three weeks a sprout began to show above the ground surface. It proved to be a vine from the tropics, but what vine? I checked with a friend familiar with tropical plants. He had an uncle who used to visit Brazil and the Amazon where this vine was native. The seeds floated down the Amazon and far out into the Atlantic Ocean. The vine has been called the "Itch Vine" because it causes a slight dermatitis on some persons. This is a case of working with an unkown.

At the present time the writer is working with another unknown plant seed collected by Michael Deems, an artist and teacher, in Venezuela, and still does not know what it is—shrub, tree or vine. The very small seeds were covered with a pulp, and before planting the pulp was removed as much as possible to avoid any chemical block that might

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be present in the pulp. After about four weeks of careful daily sprinkling, the first seedlings showed. At the end of three months about 15 seedlings appeared. Daily attention for three months takes time and patience, but here were seedlings from some unknown "pretty" tropical ornament. It got tropical care and results show that the care was about right. Only time will tell what the plant is. The care given seeds from a temperate zone, such as stratification, might kill the tropical seeds or seedlings. Methods have to be adapted to the kind of seed being germinated.

It is hoped that some of the techniques here discussed will help many others to become successful in germination work.

Symposium on the Biology of Woody Plants, Nitra, Czechoslovakia

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of the Arboretum meadows, partly surrounded by pine and other trees, with a large log fire blazing in the center of the field, music by a Hungarian gipsy orchestra, and impromptu national songs by the Slovaks, Poles and Russians. It was a truly memorable occasion, but unfortunately terminated abruptly by rain which drove the party back to the house about 8:30 p.m.

On Monday 15th two bus loads departed for a visit to the Tatra mountains, in northeastern Czechoslovakia. On the way we stopped at the forest arboretum Kysihybel, near Banska Stiavnica, founded in 1837, although most of the planting was done between 1900 and 1913, in plots 15 meters square (approximately 1/18 of an acre). It is managed by the Forest Research Institute. Conifers are especially well represented and usually doing well, including *Abies grandis, Picea orientalis,* and *Larix sibirica.* The same afternoon we saw part of a very large colony of native yew trees above Harmanec growing on a limestone hillside under beeches with some native spruce (*Picea abies*), but evidently suffering from the very shady conditions. Later we visited the large and very beautiful cave at Demanovska, and consequently did not reach our hotel at Stary Smokovec in the mountains until 9:15 p.m. Next morning we continued into the mountains and drove into two valleys where we could walk and examine the vegetation more closely, the Koprova, near the Polish border, and Ticha, as well as observe *Pinus mugo* var. *mughus* on the mountain sides above us, and *P. cembra* in the distance on the ridges. *Betula carpatica,* a local species forming a small tree often with a crooked stem was also pointed out in the Ticha valley, where the road was blocked by a snow slide and rain began to fall. This was a notable day for me since it was the first time I had seen *Gentiana verna* and *Soldanella* species growing wild and in bloom.

Next day, May 17, it was raining so instead of visiting forest plots belonging to the Forestry School at Zvolen we went to the School itself and received a briefing

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from the Principal on their organization. This includes a five year course, 550 students (of whom 400 live in), and a 16,000 acre forest, chiefly of oak and beech with some Scots pine and larch. We lunched in the large and handsomely decorated main hall of the building, and afterwards had a short tour around the town, particularly to see the old castle. During the afternoon we returned to Nitra, stopping there for an hour and then continuing to Bratislava, where a reception for the delegates was held at 8:00 p.m. in the Hotel Devin by Mr. F. Hagara, Minister for Forests and Water Economics of the Slovak National Council.

This was the final event of the eight days of the Symposium, excursions and social events, and gave everyone who remained an opportunity to express their appreciation and compliment the principal organizers, Mr. Bencat and Mr. Simancik from Mlynany. They certainly provided many occasions to be remembered and we believe also laid the foundations of new friendships amongst those participating, as well as increasing our knowledge of many other similar European institutions and what research is being conducted therein. Speaking personally, I can say that I received nothing but friendliness from all whom I met, and on several occasions additional acts of kindness or assistance which were invaluable to me in a strange country.

Our Japanese Garden

(Continued from Page 77)

chiefly with dwarf evergreen azaleas, the latter with a variety of evergreen shrubs. Several large conifers have also been moved to form a screen between the arbor and the wire fence behind it. The whole garden, therefore, has had a real face-lifting, which is by no means yet completed. Mr. William Yorozu has been most helpful in acting as interpreter and intermediary, since Mr. Fukushima speaks no English. B.O.M.

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